464-180 AU 245 47701

GB 1462170
JAN 1977

- 01-1977

1462170 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale

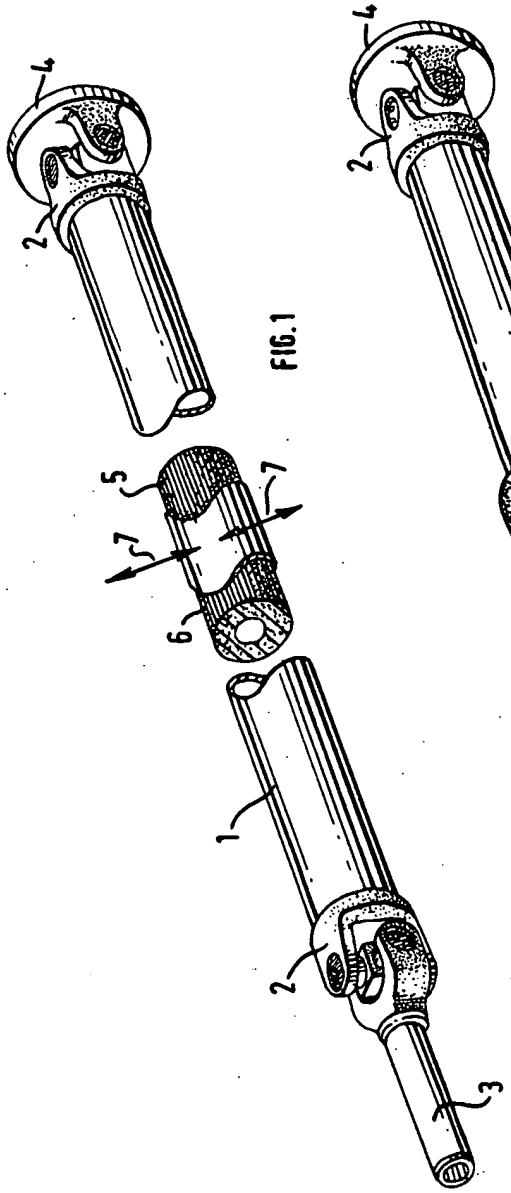

FIG. 1

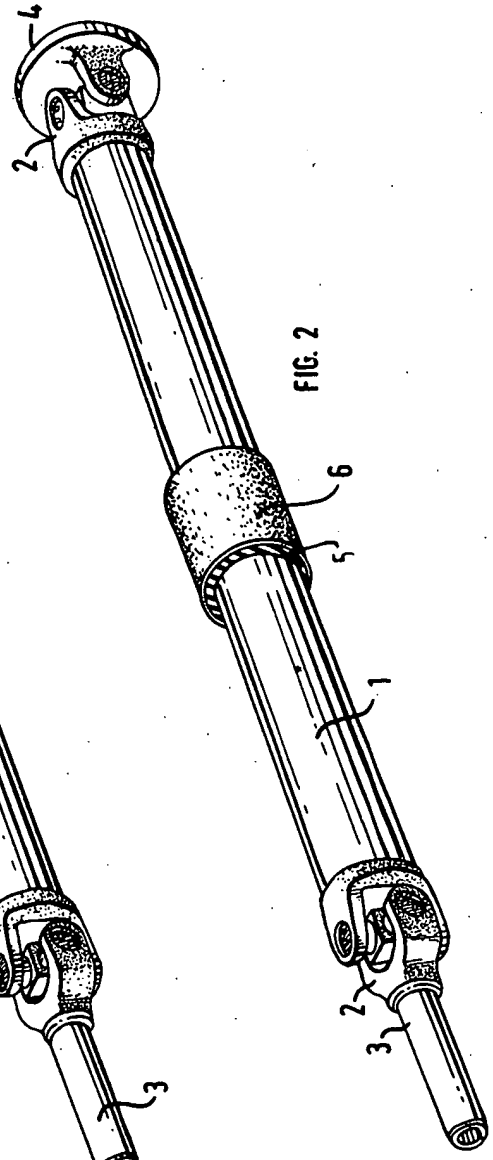

FIG. 2

PATENT SPECIFICATION

(11) 1 462 170

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(21) Application No. 35285/75 (22) Filed 27 Aug. 1975
(44) Complete Specification published 19 Jan. 1977
(51) INT CL² F16C 3/02
(52) Index at acceptance
F2U 13E
F2S 10C2A 10CX 10D3B
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(19)

(54) DRIVE SHAFT DYNAMIC DAMPER

(71) We, FORD MOTOR COMPANY LIMITED, of Eagle Way, Brentwood, Essex CM13 3BW, a British Company, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a drive shaft for a motor vehicle transmission.

It is known that problems can arise due to vibration of a drive shaft, and it is an object of the invention to provide a drive shaft which is damped to reduce vibration resulting from bending of the drive shaft.

According to the invention, there is provided a drive shaft for a motor vehicle transmission, the shaft having secured to it one or more cylindrical dampers each having a free natural fundamental frequency of radial vibration which is generally equal to a natural (fundamental or main harmonic) frequency of bending vibration of the shaft (with attached damper or dampers) to be damped, the or each damper being secured to the shaft in the region of an antinode of the bending vibration which it is to damp.

In order that the invention may be more readily understood, two embodiments of a damped drive shaft according to the invention will now be described by way of example and with reference to the accompanying drawings in which:—

Figure 1 is a perspective view, partly broken away, of a first embodiment of damped drive shaft according to the invention, and

Figure 2 is a perspective view of a second embodiment of damped drive shaft according to the invention.

Figure 1 shows a drive shaft 1 of a motor vehicle transmission connected by universal joints 2 to an input 3 and an output 4.

The shaft 1 will have a natural frequency of bending vibration with nodes located at the joints 2. When the shaft vibrates at its fundamental frequency of vibration an antinode will be located at the central region of the shaft. At main harmonic frequencies, there will be more than one antinode.

The approximate frequency or frequencies to be damped are decided upon from a consideration of the anticipated range of r.p.m. of the drive shaft. Usually, the frequency to be damped will be the fundamental frequency only, as is the case in figure 1. A cylindrical damper (5), made of rubber or other suitable material is then positioned centrally within the hollow drive shaft 4, the damper 5 being hollow. The damper 5 is selected to have a natural fundamental frequency of radial vibration (indicated by arrows 7) which is generally equal to the natural fundamental frequency of bending vibration of the shaft 1 with attached damper 5. It will be understood that the frequency of radial vibration of the damper 5 will depend upon the shape, mass, and spring rate of the rubber, and these properties will be selected as desired to provide the correct frequency. The rubber material of the damper can, if desired, be encased in a sleeve 6 of suitable material.

The embodiment of figure 2 is very similar to that of figure 1, except that the rubber sleeve-type damper is mounted on the exterior of the shaft. The casing 6 may be of a heavy material, such as metal to determine largely the mass of the damper.

Where several frequencies are to be damped, or where a single harmonic frequency having several antinodes is to be damped, more than one damper can be used, each damper being positioned in the region of an antinode of the frequency which it is to damp. Each damper will then have a natural frequency of radial vibration equal to the frequency of bending to be damped.

WHAT WE CLAIM IS:—

1. A drive shaft for a motor vehicle transmission, the shaft having secured to it one or more cylindrical dampers each having a free natural fundamental frequency of radial vibration which is generally equal to a natural (fundamental or main harmonic)

frequency of bending vibration of the shaft (with attached damper or dampers) to be damped, the or each damper being secured to the shaft in the region of an antinode of the bending vibration which it is to damp.

2. A drive shaft according to claim 1, wherein the or each cylindrical damper is made of rubber.

3. A drive shaft according to claim 1 or claim 2, wherein the or each damper is a sleeve mounted on the exterior of the shaft.

4. A drive shaft according to claim 1 or claim 2, wherein the or each damper is mounted within the drive shaft which is hollow.

5. A drive shaft according to any preceding claim, wherein the or each damper has a metal casing, the mass of which determines largely the mass of the damper.

6. A drive shaft according to any preceding claim, wherein a single damper is provided and is disposed centrally of the shaft.

7. A drive shaft substantially as herein described with reference to Figure 1 of the accompanying drawings.

8. A drive shaft substantially as herein described with reference to figure 2 of the accompanying drawings.

9. A motor vehicle including a drive shaft according to any preceding claim.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1977.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.